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It will be appreciated if subscribers will return any back publications which are of no use to them.

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(5) Straining box for latex (January, 1940).

(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).

(33) Mechanical Felling of Rubber Trees (Reprinted March, 1955).

(37A) Manuring—Magnesium Deficiencies in Rubber (July, 1954).

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(39) Clonal Seed as Planting Material (Superseding Advisory Circulars No. 26 and 27) (July, 1953).

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(44) Diplodia Dieback and Collar Rot of Hevea and Blue Spot of Crepe Rubber (June, 1954).

(47) Ustulina Rot of Rubber Trees (November, 1954).

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(57) Notes on Rubber Seedling Nurseries (Superseding Advisory Circular No. 35) (October, 1955).

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(61) Prevention of Coagulation in the Field (Superseding Advisory Circular No. 53) (September, 1958).

(62) The White Root Disease of Hevea—Fomes Lignosus (Superseding Advisory Circular No. 46) (October, 1958).

(63) Brown Root Disease of Hevea—Fomes Noxius (Superseding Advisory Circular No. 48) (December, 1958).

(64) Bark Rot and Canker of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 54) (December, 1958).

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(66) Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A) (April, 1959).

(67) A Simple Method of Control of Latex Coagulation. (February, 1960).

(68) Minor Pests of Rubber Plantations (June, 1960).

(69) Defects in Smoked Sheet. (September, 1960).

(70) Oidium Leaf Disease (Superseding Advisory Circular No. 43). *In preparation.*

(71) Tapping of Hevea Rubber (Superseding Advisory Circular No. 40). *In preparation.*

COMPARATIVE STUDIES OF THE CHEMICAL COMPOSITION OF SOME COVER PLANTS

By

A. J. Jeevaratnam

Cover plants and mulching materials vary in their ability to improve the fertility of the soil, depending on the nature and amount of dry matter produced and on the chemical composition of the different plants.

Results of comparative studies of the amount of dry matter produced and the chemical composition of three leguminous cover crops, Pueraria phaseoloides, Centrosema pubescens and Desmodium ovalifolium, and two non-leguminous cover plants, Mikania scandens and Tripsacum laxum (Guatemala grass) are reported. Guatemala grass was found to have the lowest content of N, P, Ca and Mg, but had the greatest total amount of plant nutrients N, P and K, by virtue of the relatively large quantities of dry matter which it produced.

Two of the leguminous cover plants investigated, Pueraria phaseoloides and Centrosema pubescens, returned larger amounts of nitrogen than did Mikania scandens. The third leguminous cover plant, Desmodium ovalifolium, was in fact poorer in chemical composition than Mikania. The non-leguminous cover plants contained large quantities of K but were low in Ca and Mg.

These results indicate that the chemical composition of cover plants and mulching materials can exert considerable influence on the nutrition of Hevea.

The need for a policy of cover plant cultivation in rubber plantations is already clear. The subject has been covered in a review (Watson, 1957). The topography of the rubber growing districts of Ceylon and the nature and amount of rainfall make it necessary for the land not to be kept bare of vegetation at any stage.

One would not be far wrong in saying that through years of practical experience an equilibrium has been established in respect of cover plant policies in Ceylon. Introduced covers of the leguminous type are favoured in the better managed plantations. *Pueraria phaseoloides, Centrosema pubescens* and *Desmodium ovalifolium* are cultivated singly or in mixtures. The preference for one type of leguminous cover to another is a matter of opinion based on field observations. *Pueraria* is preferred by many as it grows fast and lays down a good mulch sooner than the others. Its drawbacks are considered to be that it tends to compete with the rubber plants in the early stages, and that it dies out sooner under shade. *Centrosema pubescens* is preferred by those who are worried about root competition and by those who want a cover to persist longer under shade. *Desmodium ovalifolium*, a herbaceous leguminous plant, is considered to last longest under shade and to stand up better to prolonged periods of drought and, for these reasons, is also commonly grown.

The maintenance of a pure stand of leguminous cover entails systematic management and, when this is lacking, one finds in replantings all stages of competition with natural covers such as *Mikania scandens* and grasses.

The cultivation of cover plants is most important in the early years of the life of a rubber plantation. For this reason, one of the requirements laid down in Ceylon for the payment of the third instalment, when replanting under the Rubber Replanting Subsidy Scheme, is the establishment of a leguminous ground cover during the first wet weather after uprooting operations have been completed. Exceptions are made in the case of dry districts where *Mikania scandens* and *Passiflora foetida* may be allowed as ground cover subject to special permission of the Rubber Replanting Advisory Board. Some plantations maintain a pure stand of leguminous cover up to the time of obtaining the third instalment and thereafter tolerate *Mikania* but remove noxious weeds.

An estate in the Kegalle District of Ceylon has reported that three and a half labourers per acre per year are needed for the first three years to weed an acre and maintain it under pure leguminous cover, whereas two and a half labourers, per acre per year are needed for the same period if species like *Mikania* are allowed to grow and only noxious weeds are removed.

Although the main purpose of cultivating cover plants is to control erosion, the influence of cover plants on soil improvement is of considerable importance. This is brought about by the addition to the soil of organic matter and mineral nutrients through the natural mulch of decaying leaves while the cover plant is growing, and finally by the decay of the whole plant when it dies out.

Since cover plants are cultivated for the purpose of benefiting the rubber plants, care is always taken not to allow them to compete to any great extent with the rubber plants at any stage. For this reason a strip of about 4 to 6 feet wide along the planting row or a circle of about 2 to 3 feet radius round each rubber plant is clean weeded and kept clear of all undergrowth including cover plants. In some plantations this clean-weeded area is mulched with the slashed cover. However, the practical difficulty has been that sufficient material for mulching is not always available.

Investigations on soil analysis carried out at the Rubber Research Institute of Ceylon suggest that the above scheme of soil amelioration may be inadequate.

Numerous soil samples collected from different rubber growing areas have shown, in general, a high gravel content (*i.e.* the fraction above 2 mm.), a low clay content, a very low cation exchange capacity and an even lower percentage saturation. The analysis of a typical lateritic gravelly loam is reported in Table 1.

The results indicate that these soils have a very low retentive capacity for moisture and nutrients. The only way to improve this situation is to increase the organic matter content of the soil. This appears possible by the cultivation of a quick-growing grass, such as *Tripsacum laxum* (Guatemala grass), in association with leguminous covers. Observations on the growth of this grass in rubber plantations showed that it is capable of providing sufficient material for mulching the entire clean weeded area along the planting rows three to four times a year. The practice of cultivating Guatemala grass and using it for mulching was, therefore, recommended in rubber plantings in Ceylon (Baptiste & Jeevaratnam, 1959).

In view of the conflicting opinions on the respective merits of leguminous and non-leguminous cover plants and in view of the large quantities of organic matter produced by *Tripsacum*, compared with others, a comparative study of the chemical composition of cover plants was undertaken.

Experimental:

Studies on the chemical composition were carried out on the following leguminous and non-leguminous cover plants growing under field conditions on commercial estates:

Pueraria phaseoloides
Centrosema pubescens
Desmodium ovalifolium
Mikania scandens
Tripsacum laxum

The investigations covered the following aspects:—

1. Dry matter produced by the aerial parts of the different cover plants.
2. Chemical composition of the aerial parts in respect of N, P, K, Ca and Mg.
3. The effect on the soil of cultivating *Pueraria*, *Centrosema* and *Desmodium*, as reflected by the chemical composition of the soil underneath each cover.

Sampling

An estate in the Southern Province of Ceylon which carried pure stands of well grown *Pueraria*, *Centrosema* and *Desmodium* in a three-year-old replanting was selected as a source of the samples of the leguminous covers. Since present cover plant policies do not allow *Mikania* as a cover it was not possible to obtain samples from a pure stand of *Mikania* from the same clearing. Hence samples of this cover plant were taken from an adjacent old-seedling area. Samples of Guatemala grass were obtained from an estate in the Kalutara District which had carried the plant for three years.

Estimations of dry matter produced were confined to the vegetative growth above ground level. Ten random samples from an area of one square foot each were taken in the case of all cover plants except Guatemala grass. Green leaves, petioles, stems and fallen leaves which had not started to decompose were included in the samples. In the case of Guatemala grass, estimations of dry matter produced were made from larger areas of 120 sq. ft. each because of uneven growth. Only two samples were weighed for this estimation.

Soil samples underneath the covers *Pueraria*, *Centrosema* and *Desmodium* were taken up to a depth of 6 in. at each site sampled for dry matter.

Methods

Estimations on dry matter produced were made on the entire samples taken in the case of the first four covers. For Guatemala grass, sub-samples had to be taken for this estimation. Samples that were dried for estimation of dry matter were subsequently used for chemical analysis.

Nitrogen was determined by the normal micro-kjeldahl method, phosphorus by the ammonium-vanado-molybdate method, potassium by flame photometry using oxy-hydrogen flame, calcium by precipitation as oxalate, and calcium and magnesium by the versenate titration using Eriochrome Black indicator, the magnesium being determined by difference.

Results:

Dry Matter Produced and Chemical Composition

The amount of dry matter produced by the different cover plants and their chemical composition are reported in Table 2.

Dry matter produced by each cover plant is given in grams per square foot and the chemical composition is expressed as a percentage of the oven dry samples. The standard error for each determination on the ten samples is also reported.

It must be stated at the outset that the values reported cannot be considered absolute 'norms'. The samples were taken at a particular site and at a particular time and consequently the results can be used only for comparative purposes.

The first point to note is that Guatemala grass (*Tripsacum*) produced significantly greater amounts of dry matter than any other cover plant investigated and that *Pueraria* ranked second in that respect.

With regard to nitrogen, *Centrosema* gave the highest content which was significantly greater than that of *Desmodium*, *Mikania* and of *Tripsacum*. Among the legumes, *Desmodium* gave the lowest nitrogen content, which was even lower than that of *Mikania*. The nitrogen content of Guatemala grass (*Tripsacum*) was the lowest of all. For convenience the differences that are significant between pairs of cover plants are indicated in Table 3.

In respect of phosphorus, *Centrosema* gave the highest content followed by *Mikania*, levels were low and of the same order in *Pueraria*, *Desmodium* and *Tripsacum*.

The non-legumes showed significantly higher potassium contents than the legumes. Within the legumes, *Centrosema* gave significantly higher potassium than the rest.

The calcium content of *Pueraria* was significantly higher and that of *Tripsacum* was significantly lower than all others.

With regard to magnesium, the legumes had, in general, a significantly higher content than the non-legumes. Guatemala grass showed the lowest magnesium content.

A clearer picture of the differences between cover plants is obtained when quantities are expressed in pounds per acre. These data are presented in Table 4.

Among the legumes, *Pueraria* returned the highest quantities of dry matter, nitrogen, potassium, calcium and magnesium. *Centrosema* returned lower amounts of chemical constituents than *Pueraria* because of the lower amounts of dry matter produced. *Desmodium* returned the lowest quantities of dry matter, nitrogen, phosphorus and potassium of all the cover plants investigated.

Mikania returned significantly higher quantities of potassium than the legumes.

Tripsacum (Guatemala grass), by virtue of the high quantities of dry matter produced, returned the highest quantities of nitrogen, phosphorus, and potassium.

Analysis of Soil Samples

Results of chemical determinations on the soil samples under the three leguminous covers are reported in Table 5.

Levels of organic carbon, total nitrogen, C/N ratio, phosphorus and potassium in HCl extracts, and ammonia and nitrate nitrogen at the time of sampling are reported.

It will be noted that the soil under *Pueraria* is better in all respects except in phosphorus.

Discussion:

On the basis of dry matter produced, Guatemala grass is significantly better than all other cover plants investigated. Fourteen tons of dry matter for each cultivated acre is a formidable quantity indeed. It will assume even greater significance when it is realised that Guatemala grass can be harvested about three to four times a year. It may be argued that Guatemala grass cannot be considered a cover plant for purposes of valid comparisons of this nature. The cover plants, in general, produce a continuous mulch of their own and are not harvested regularly for thatching purposes. However, since Guatemala grass is cultivated to obtain a supply of material for thatching the clean weeded areas along the rubber tree rows, a knowledge of the amount of dry matter and chemical constituents returned by the grass should be of great value. The fact that the dry matter produced by *Pueraria* was greater than that produced by other leguminous cover plants and by *Mikania* gives confirmation to the opinion that *Pueraria* spreads fast and lays down a good mulch.

Comparisons with *Mikania* have to be interpreted with caution, owing to the age of the clearing from which it was sampled.

Pueraria and *Centrosema* returned significantly larger quantities of nitrogen, calcium and magnesium than the others. It is interesting to note that the two legumes returned larger quantities of nitrogen than did *Mikania*. These results are in keeping with those reported from Malaya that a mixed leguminous cover returned greater amounts of nitrogen than did grasses and *Mikania* (Rubber Research Institute of Malaya, 1960), but it must be pointed out that the differences observed in Ceylon are not as great as those reported by Malaya. This may perhaps be due to the disparity in the age of the clearing from which samples of *Mikania* were obtained for the investigations reported in this paper.

The phosphate content in all cover plants investigated was very low. The non-legumes returned significantly larger quantities of potassium compared to the legumes. *Desmodium* returned the lowest quantities of all mineral elements and, if this can be confirmed by further investigations, the recommendation to cultivate this legume in preference to *Mikania* will have to be reviewed.

The overall quantities of mineral elements returned to the soil, except for calcium and magnesium is greatest in the case of Guatemala grass by virtue of the high amount of dry matter produced. How much of these mineral elements will be readily available for absorption by *Hevea* roots will be dependent on the Carbon/Nitrogen ratio of the material. Unfortunately this has not been determined but it would be expected to be high, and therefore the plant nutrients from this material may not be so readily available as those from leguminous cover plants.

It has been suggested that there is a symbiotic association of *Hevea* roots with a fungus (mycorrhiza) permitting the rubber roots to function as facultative saprophytes (Park, 1928). If this is so, the non-availability of nutrients will not be a major drawback.

However, a comparison of the nutrient ratios of N: P_2O_5: K^2O in the different cover crop materials will be interesting. The approximate nutrient ratios obtained were as follows:—

	N	P_2O_5	K_2O
Pueraria ...	10	1	2
Centrosema ...	6	1	1.5
Desmodium ...	8	1	2
Mikania ...	5	1	7
Tripsacum ...	4.5	1	12.5

There is no doubt that the legumes are relatively rich in nitrogen, whereas the non-legumes have a higher potassium content. As has been pointed out earlier, phosphate content is generally very low.

If the soils are low in phosphorus and if the organic matter added to the soil is also low in phosphorus, response by *Hevea* to added phosphate will almost be certain. This is likely to be the reason why a response to added phosphate has almost always been obtained in manurial trials with *Hevea* in many countries.

The fact that non-legumes are high in potassium suggests that when mulching with non-legumes is carried out application of nitrogen and phosphate would be beneficial.

A field experiment to test these points on the growth of *Hevea* plants has been laid down and it was hoped to present the preliminary results of this experiment in this paper. Unfortunately it is considered still too premature to report on these results.

However the results of another experiment, where the effect of the cover plants on the growth of young *Hevea* plants was studied, may be quoted to lend support to the findings reported in this paper regarding the choice of cover plant and the advantages of thatching with Guatemala grass.

Cover Plant Treatment	**Average girth in inches of 3-year-old plants**
Pueraria	9.1
Centrosema	9.1
Desmodium	8.3
Mikania	9.1

The *Hevea* plants were manured with an NPK + Mg fertiliser mixture.

Girth measurements recorded on an equal number of trees in an adjoining area of the same field which carried *Pueraria* and Guatemala grass and was mulched with Guatemala grass gave an average figure of 9.3 inches.

Conclusions:

Of the leguminous cover plants that are commonly cultivated under *Hevea* in Ceylon, *Pueraria* and *Centrosema* have been found to be better than *Desmodium*. In fact, *Desmodium* was found to be even poorer than *Mikania* in many respects.

Legumes have a higher nitrogen, calcium and magnesium content, whereas the non-legumes are high in potassium. All cover plants investigated have a very low phosphorus content.

Mulching with the loppings of Guatemala grass returns large quantities of organic matter and nutrients to the soil. When this practice is adopted fertiliser requirements of *Hevea* should be determined in the light of this factor.

References:

Baptiste, E. D. C. & Jeevaratnam, A. J. (1959). A note on Guatemala grass as mulch for rubber plants. *Rubb. Res. Inst. Ceylon Quart. J.* **35,** 26.

Park, M. (1928). A preliminary note on a mycorrhizal fungus of tea roots. *Trop. Agriculturist* **50,** 171.

Rubber Research Institute of Malaya (1960). The nitrogen content of leguminous creeping covers. *R.R.I. Plant Bull.* No. **47,** 35.

Watson, G. A. (1957). Cover plants in rubber cultivation. *J. Rubb. Res. Inst. Malaya* **15,** 2.

TABLE 1

Chemical Analysis of Soil Samples

Results are calculated on an oven-dry basis

Depth in inches		0–3	3–10	10–16	16–41
pH		4.90	4.90	4.92	4.98
Gravel in original sample	%	49.5	53.3	63.2	48.8
Coarse sand	%	48.6	44.5	44.3	38.9
Fine sand	%	20.1	18.6	14.6	14.3
Silt	%	8.2	9.9	8.5	12.6
Clay	%	18.9	21.8	27.8	29.1
Organic carbon	%	2.76	2.15	1.12	0.46
Nitrogen	%	0.205	0.142	0.068	0.045
Phosphorus in HCl ext.	p.p.m.	205	130	140	145
Potassium in HCl ext.	%	0.109	0.094	0.089	0.064
Exchangeable calcium m. eq.	%	0.77	0.40	0.29	0.37
Exchangeable magnesium m. eq.	%	0.18	0.05	0.15	0.11
Total metal ions m. eq.	%	1.1	0.6	0.3	0.2
Cation exchange capacity m. eq.	%	5.3	4.1	3.2	1.9
Moisture in air dry sample	%	4.58	4.93	4.90	6.10

TABLE 2.

Dry Matter Produced by Different Cover Crops and their Chemical Composition

Results are calculated as percentage on oven dry basis

	No. of samples	Dry matter produced g/sq. ft.		Nitrogen %		Phosphorus %		Potassium %		Calcium %		Magnesium %	
		$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.
Pueraria phaseoloides ...	10	90.2	5.74	1.80	0.084	0.075	0.006	0.275	0.021	1.448	0.102	0.860	0.100
Centrosema pubescens ...	10	56.8	5.47	1.99	0.082	0.138	0.017	0.389	0.046	0.982	0.072	0.873	0.120
Desmodium ovalifolium ...	10	73.8	8.63	1.27	0.025	0.071	0.012	0.249	0.009	0.952	0.051	0.732	0.061
Mikania scandens ...	10	71.8	9.36	1.58	0.083	0.126	0.009	1.626	0.156	0.824	0.056	0.504	0.042
Tripsacum laxum ...	5	330.0*	33.0	0.73	0.049	0.071	0.013	1.690	0.282	0.172	0.024	0.223	0.016

* The dry matter figure for *Tripsacum* is based on two samples.

TABLE 3.

Significant differences between Pairs of Cover Crops

N_1 / N_2	*Pueraria*						*Centrosema*						*Desmodium*						*Mikania*					
	d.m.	N	P	K	Ca	Mg	d.m.	N	P	K	Ca	Mg	d.m.	N	P	K	Ca	Mg	d.m.	N	P	K	Ca	Mg
Centrosema pubescens ...	$\underline{**}$		$\overline{**}$	$\overline{*}$	$\underline{**}$																			
Desmodium ovalifolium ...		$\underline{**}$			$\underline{**}$			$\underline{**}$	$\underline{**}$	$\underline{**}$														
Mikania scandens ...			$\overline{**}$	$\overline{**}$	$\underline{**}$	$\underline{**}$		$\underline{**}$		$\underline{**}$		$\underline{*}$		$\overline{**}$	$\overline{**}$	$\overline{**}$		$\underline{*}$						
Tripsacum laxum ...	$\underline{**}$	$\underline{**}$		$\overline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$		$\overline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$	$\underline{**}$

* 5% level $\underline{**}$ N_1 greater than N_2 ** 1% level $\overline{**}$ N_2 greater than N_1

TABLE 4.

Dry Matter and Chemical Composition of Cover Crops in Pounds Per Acre.

Cover plant	Dry matter	N	P	K	Ca	Mg
Pueraria phaseoloides ...	8662	155.9	6.5	23.8	125.4	74.5
Centrosema pubescens ...	5455	108.5	7.5	21.2	53.6	47.6
Desmodium ovalifolium ...	7087	90.0	5.0	17.7	67.5	51.9
Mikania scandens ...	6895	108.9	8.7	112.1	56.8	34.8
Tripsacum laxum ...	31690	231.3	22.5	535.6	54.5	70.7

TABLE 5.

Nutrient Content of Soil (0—6 in) Under Three Cover Crops

	No. of samples	Organic carbon %		N%		C/N Ratio	P (p.p.m.)		K%		NO_3—N (p.p.m.)		NH_3—N (p.p.m.)	
		$\bar{x}$	S.E.	$\bar{x}$	S.E.		$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.
Pueraria phaseoloides ...	10	1.51	.13	.097	.009	16.8	63.5	3.8	.019	.001	11.0	1.0	13.4	0.8
Centrosema pubescens ...	10	2.33	.27	.130	.013	17.8	100.0	18.6	.017	.001	8.4	1.1	11.0	1.0
Desmodium ovalifolium ...	10	2.13	.25	.115	.008	20.5	52.5	6.3	.017	.001	7.3	1.0	7.4	0.9

PRESERVATION OF SHEET RUBBER AGAINST MOULD
PART I. MOULD GROWTH IN AQUEOUS MEDIA

By

K. F. Heinisch and M. Nadarajah

Introduction:

Methods of prevention of mould growth on sheet rubber have been widely investigated and paranitrophenol has been accepted as an efficient and suitable fungicide.

There are, however, some serious disadvantages in the use of paranitrophenol. Manufacturers sometimes object to it as, under alkaline conditions, the paranitrophenol may seriously stain the rubber yellow and this stain bleeds out in manufactured goods. Furthermore paranitrophenol is toxic by skin absorption and by ingestion and may cause, after frequent and prolonged skin contact, dermatitis, cyanosis and other ailments. For this reason its use in Ceylon has been disallowed since 1957 by the Ceylon Department of Labour.

The climatic conditions in the rubber growing districts of Ceylon where the annual rainfall may be as high as 180 inches, and the poor storage conditions on estates necessitate a much more extensive use of fungicides for the preservation of sheets than in Malaya or Sumatra. Some investigations have therefore been carried out to find a substitute for paranitrophenol.

The size of the sheet-producing estates in Ceylon, compared with that of other rubber growing countries, is generally small and consequently a factory output of several days has to be accumulated before sufficient material is obtained for despatch. The main drawback, however, is that the rubber is never packed on the estates but is only bundled and transported to the packing houses in the ports of Colombo or Galle. It might, therefore, take up to two weeks before the rubber is finally packed and is ready for shipment. It is to be expected, therefore, that this delay, especially during the humid conditions of monsoon periods, results in a prolific development of mould.

Experience has shown that under these conditions smoking of the sheets provides only limited protection against mould. It is not possible to use the colour of the sheets and the period of smoking as an indication of the degree of mould resistance, as it has been often noticed that sheets which were supposed to be well smoked showed less resistance against mould than light coloured sheets which had been smoked only for a short period. It seems that some active components of the tar are volatile so that the resistance to mould growth decreases with the storage time (1).

The liability to mould can be reduced by soaking the freshly milled sheets thoroughly in water, but a noticeable effect is only obtained after a prolonged period of soaking (2, 3). The addition of sodium bisulphite to latex prior to coagulation at a rate of 1 oz. per 100 lb. dry rubber also produces a certain inhibiting effect (4). Sheets cannot, therefore, be made entirely immune to mould by smoking in addition to the above treatments and, under adverse conditions, fungicides have to be used.

The natural flora on smoked sheet appears to be rather limited and only a few fungi seem to develop prolifically. Of these *Penicillium species* (*P. glaucum, P. notatum, P. miczynskii, P. chrysogenum*), *Aspergillus species* (*A. griseus, A. flavus, A. ustus, A. niger*) (2, 5), *Fusarium species, Trichoderma species, Chromosporium species* (6) as well as *Oospora species* (3) have been reported. Fungi preferring quebrachitol as the carbon source should, according to Bobilioff (7), show prolific growth on rubber.

Experimental:

Pure cultures of four of the most common fungi found in Ceylon smoked sheet which have been identified at the Commonwealth Mycological Institute, London, were used for the experiments.

These are:

Penicillium miczynskii Zal.
Penicillium chrysogenum Thom.
Aspergillus flavus Link.
Aspergillus niger Van Tiegh.

From preliminary experiments (4) the following fungicides have been selected, using paranitrophenol as the comparative standard.

TABLE I

Fungicides Tested

Trade Name	Chemical Composition	Solubility
P.N.P.	Paranitrophenol	Sol. in water
Shirlan	Sodium salt of Salicylanilide	Sol. in water
Preventol ON	Sodium-o-phenylphenate	Sol. in water
Santobrite	Sodiumpentachlorophenate	Sol. in water

The efficacy of progressive quantities of these fungicides against the isolated mould species was determined both in an artificial liquid medium and in rubber serum after one week's incubation at room temperature.

The temperature for optimum mycelial growth of the fungi, determined in a liquid medium with glucose as carbon source, has been found to be:

Penicillium miczynskii	29°C
Penicillium chrysogenum	30°C
Aspergillus flavus	33°C
Aspergillus niger	37°C

The artificial medium consisted of an aqueous solution containing:

0.5% Ammonium chloride,
0.1% Potassium dihydrogen phosphate,
0.05% Magnesium sulphate,
2% Glucose.

50 ml. of this medium were poured into 100 ml. Erlenmeyer flasks and sterilized at a pressure of 15 lb./sq. in. for 15 minutes. To this were added the fungicides as aqueous solutions in volumes less than 2 ml., and the pure fungi culture as 1 ml. of an aqueous suspension. After 7 days' incubation at room temperature (26 ± 2°C) in the dark the mould was filtered through filter papers previously dried at 60°C and determined gravimetrically after drying to constant weight at 60°C.

To simulate nutrient conditions in freshly milled sheets, experiments were carried out with a medium consisting of fresh unneutralized rubber serum obtained by coagulating field latex with formic acid at pH 4.6. The serum was autoclaved at 10 lb./sq. in. for 10 minutes, the precipitate of proteins filtered off after cooling, the solution sterilized at 15 lb./sq. in. for ten minutes and then used (8).

The results are presented in Tables 2 and 3 and a summary of the concentrations at which mould growth is inhibited is given in Table 4.

TABLE 2

Weight of mould in grams in artificial medium containing glucose

Mould	Concentration	Fungicides			
		P.N.P.	Shirlan	Santobrite	Preventol ON
Penicillium miczynskii	blank ...	0.182	0.182	0.248	0.248
	1: 250,000 ...	0.223	0.156	0	0.263
	1: 100,000 ...	0.185	0.198	0	0.146
	1: 50,000 ...	0.150	0.116	0	0.123
	1: 25,000 ...	0.045	0	0	0
	1: 10,000 ...	0	0	0	0
Penicillium chrysogenum	blank ...	0.273	0.273	0.273	0.273
	1: 250,000 ...	0.268	0.308	0	0.264
	1: 100,000 ...	0.280	0.153	0	0.137
	1: 50,000 ...	0.277	0.021	0	0.081
	1: 25,000 ...	0.143	0	0	0
	1: 10,000 ...	0	0	0	0
Aspergillus flavus	blank ...	0.091	0.091	0.260	0.260
	1: 250,000 ...	0.105	0.054	0	0.191
	1: 100,000 ...	0.073	0.045	0	0.124
	1: 50,000 ...	0.082	0.006	0	0.067
	1: 25,000 ...	0.020	0	0	0
	1: 10,000 ...	0	0	0	0
Aspergillus niger	blank ...	0.182	0.182	0.248	0.248
	1: 250,000 ...	0.223	0.156	0	0.263
	1: 100,000 ...	0.185	0.198	0	0.146
	1: 50,000 ...	0.150	0.116	0	0.123
	1: 25,000 ...	0.045	0	0	0
	1: 10,000 ...	0	0	0	0

TABLE 3

Weight of mould in grams in unneutralized rubber serum

Mould	Concentration	Fungicides			
		P.N.P.	Shirlan	Santobrite	Preventol ON
Penicillium miczynskii ...	Blank	0.192	0.192	0.192	0.192
	1: 100,000	0.164	0.154	0	0.129
	1: 50,000	0.171	0.043	0	0.046
	1: 25,000	0.107	0	0	0
	1: 10,000	0	0	0	0
Penicillium chrysogenum		No mould development			
Aspergillus flavus ...	Blank	0.223	0.223	0.223	0.223
	1: 100,000	0.165	0.247	0.073	0.210
	1: 50,000	0.145	0.190	0	0.158
	1: 25,000	0.155	0.036	0	0
	1: 10,000	0.074	0	0	0
	1: 5,000	0	0	0	0
Aspergillus niger ...	Blank	0.210	0.210	0.210	0.210
	1: 100,000	0.193	0.203	0.022	0.165
	1: 50,000	0.176	0.185	0	0.035
	1: 25,000	0.130	0.034	0	0
	1: 10,000	0	0	0	0

TABLE 4

Concentrations for inhibition of mould growth

Medium	Mould	Fungicides			
		P.N.P.	Shirlan	Santobrite	Preventol ON
Artificial medium glucose	*Pen. miczynskii*	1:10,000	1:25,000	1:250,000	1:25,000
	Pen. chrysogenum	1:10,000	1:25,000	1:250,000	1:25,000
	Asp. flavus	1:10,000	1:25,000	1:250,000	1:25,000
	Asp. niger	1: 5,000	1:25,000	1:250,000	1:25,000
Unneutralised Rubber Serum	*Pen. miczynskii*	1: 5,000	1:25,000	1:100,000	1:25,000
	Pen. chrysogenum	—	—	—	—
	Asp. flavus	1: 5,000	1:10,000	1: 50,000	1:25,000
	Asp. niger	1:10,000	1:10,000	1: 50,000	1:25,000

Since freshly milled sheets are faintly acidic, the influence of increasing volumes of a 0.05% formic acid solution on the pH and the stability of 50 ml. of the fungicidal aqueous solutions were investigated. The results are given in Table 5.

TABLE 5

pH of fungicidal solutions after the addition of a 0.05% formic acid solution

Fungicide	Concn.	Ml. of 0.05% formic acid added				pH at which precipitate appears
		0	2	10	18	
Paranitrophenol ...	0.5	3.5	2.8	2.3	2.1	—
	0.2	3.6	2.7	2.3	2.1	—
	0.1	3.7	2.6	2.1	2.1	—
Shirlan ...	0.5	10.0	9.5	8.4	8.3	8.5
	0.2	9.0	7.8	7.7	7.5	7.8
	0.1	7.7	7.2	7.0	4.4	7.3
Santobrite ...	0.5	9.8	8.7	6.9	6.9	9.2
	0.2	9.2	7.0	6.3	6.0	7.9
	0.1	8.2	6.3	5.6	4.6	6.5
Preventol ON ...	0.5	10.0	9.8	9.8	—	9.8
	0.2	9.7	9.6	9.3	—	9.4
	0.1	8.8	8.6	5.9	—	8.2
	0.05	8.8	8.4	2.9	—	—

Discussion:

Under the conditions of these experiments Santobrite, Preventol ON and Shirlan appear to be superior in their fungicidal activity to paranitrophenol in either an artificial liquid medium or in rubber serum. All these fungicides are sodium salts soluble in water. In acidic medium they are unstable and tend to precipitate out. As regards the free phenols, only paranitrophenol (1.6% at 25°C) and, to a much lesser extent, orthophenylphenol, are slightly soluble in water, and these are stable in acidic medium only at these low concentrations.

Phenols, cresols and chlorophenols are known to be more effective in an acidic medium and to exhibit reduced activity in alkaline solutions (9).

Preventol ON maintains the same activity in different media and against all of the four fungi at an inhibiting concentration of 1:25,000. Although Santobrite and Preventol ON precipitate out in acidic medium they remain in unneutralised rubber serum as a very fine dispersion and show nevertheless the highest activity of all the fungicides tested, viz. 1:50,000—1:100,000 for Santobrite and 1:25,000 for Preventol ON.

It has also been found that sodium bisulphite, normally used in sheet manufacture in Ceylon at a rate of 1 oz. per 100 lb. dry rubber, has a marked delaying effect on mould growth and inhibition has been obtained in rubber serum at a concentration of 1:1,000.

Although *Penicillium chrysogenum* has been observed frequently on sheet rubber, it showed no growth at all in unneutralized rubber serum, due to the presence of some natural inhibitors. Normal mycelial growth of this mould occurred in the synthetic medium.

References:

1. Ultee, A. J. *Arch. Rubbercult. Ned.-Ind.* (1923) **7** 73.
2. De Vries, O. *Arch. Rubbercult. Ned.-Ind.* (1919) **3** 346.
3. O'Brien, T. E. H. *Rubb. Res. Sch. Ceylon Bull.* (1926) No. **42.**
4. Heinisch, K. F. & Nadarajah, M. Proceedings of the Natural Rubber Research Conference, Kuala Lumpur (1960) 893.
5. Heinisch, K. F. & Kuhr, P. *Arch. Rubbercult.* (1957) **34** 1.
6. Sharples, A. *Fed. Mal. States Dept. Agr. Bull.* (1914) **19.**
7. Bobilioff, W. *Arch. Rubbercult. Ned.-Ind.* (1929) **13** 118.
8. Taysum, D. H. *J. Rubb. Res. Inst. Malaya* (1957) **15** 19.
9. Bennett, E. D. Advances in Applied Microbiology (1959) **1** 12.

Figure 1. Algal spot condition on leaves. Lighter coloured areas represent the rusty red discolouration.

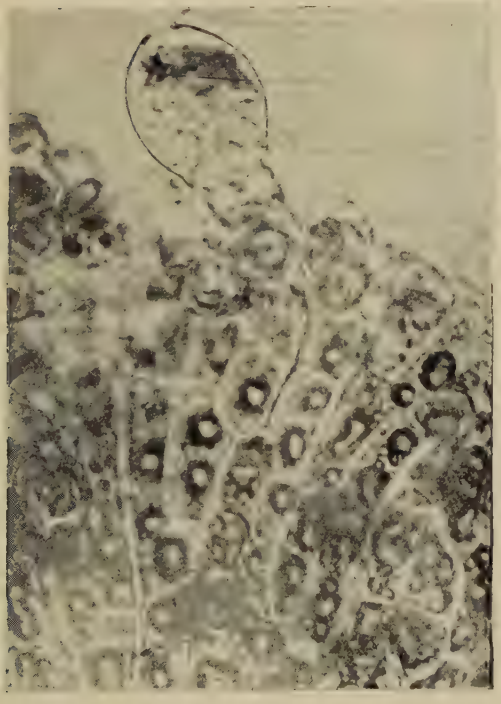

Figure 2. Part of *Phycopeltis sp.* colony with sporangium.

Figure 3. *Cephaleuros mycoidea* aerial algal threads bearing sporangia.

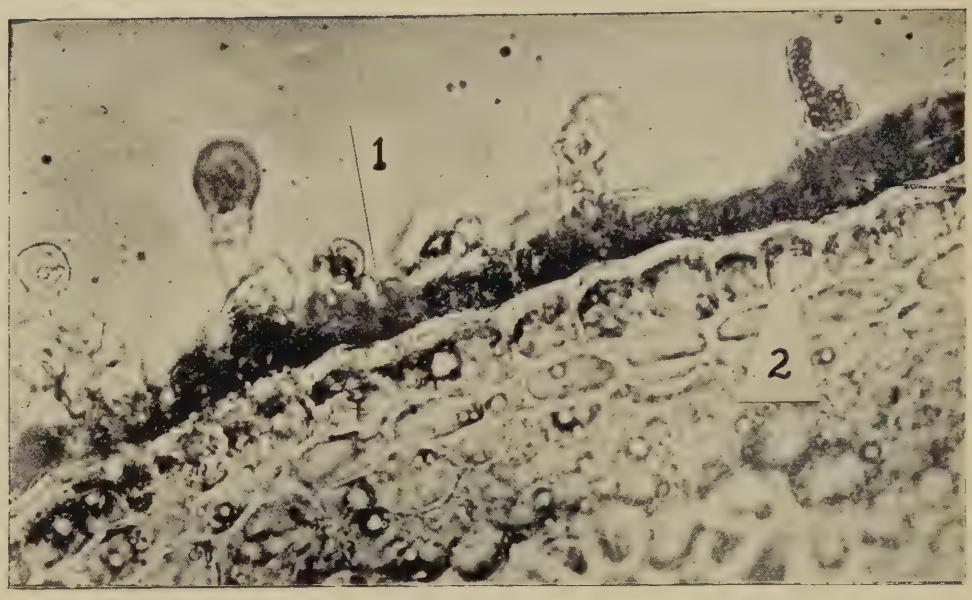

Figure 4. T.S. of leaf illustrating the absence of a parasitic relationship in *Phycopeltis sp.* 1. Superficial algal growth. 2. Cuticle, epidermis and underlying tissue undamaged.

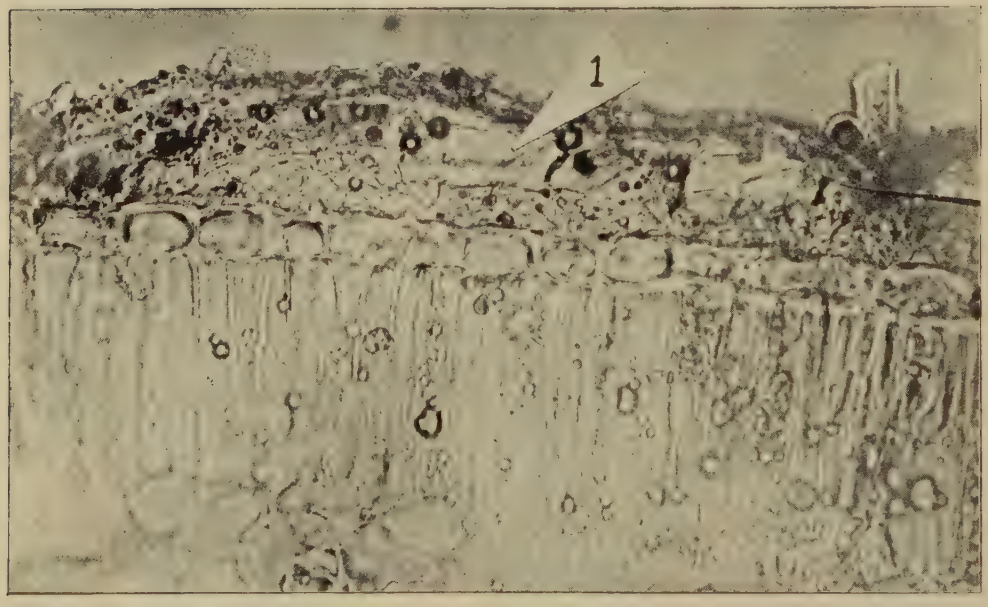

Figure 5. T.S. of leaf illustrating a parasitic relationship in *Cephaleuros mycoidea.* 1. Algal cells growing between the displaced cuticle and the epidermal cells.

ALGAL SPOT OF HEVEA LEAVES IN CEYLON

By

H. L. Munasinghe

This short article is only meant as a record of the Algal spot condition in Ceylon. No attempt is made to deal with it in detail. Two algae were found to cause the condition. Phycopeltis sp. as an epiphyte and Cephaleuros mycoidea as a mild parasite. This condition is of no economic importance and does not warrant any control measures.

During the early part of May and the commencement of the monsoon rains, a rusty red discolouration of leaves of Hevea was reported from Yatadola Estate in the Kalutara District. The discolouration occurs only on the upper surfaces of the leaves and covers a greater part of the leaf area. In Figure 1 the lighter coloured patches on the leaves represent the rusty red discolouration.

Environmental conditions:

The field where these symptoms occurred is on the western slope of a hill. It was evident on a visit by the Director and the writer to this field that some amount of mist persists during the early hours of the day. The leaf canopies are dense and the general conditions were suggestive of a humid atmosphere. The field, due to its steep western aspect, gets very little sunshine during the morning.

Causative organisms:

Microscopic examination revealed the presence of two algae, closely akin to each other but widely differing in their relationship to the host.

(*a*) A member of the algal sub-family Trentepohlieae and in all probability of the genus *Phycopeltis*. For the purpose of this record, this organism will be tentatively called *Phycopeltis sp.* A detailed study of the life history and taxonomy is necessary before the correct generic and specific names can be arrived at. Figure 2 shows a part of a colony with a sporangium.

(*b*) A species of *Cephaleuros*. Algal spot of Hevea leaves in Malaya is known to be caused by *Cephaleuros mycoidea*. The writer proposes to apply this name to the species recorded here, until further classification is made. Figure 3 shows the erect algal threads bearing the sporangia.

Most of the rusty red discolouration is a result of the *Phycopeltis sp.* Small colonies of the alga coalesce to form the patches covering a large area of the leaf. *Cephaleuros mycoidea* causes a few small spots readily distinguishable by the reddish purple colour of the spots and also by the presence of reddish orange tufts of algal threads bearing the sporangia.

Pathogenicity:

Species of *Phycopeltis* are known to be epiphytic on leaves of various plants and other substrata. The *Phycopeltis sp.* dealt with here is without doubt only epiphytic,

growing superficially, and does not establish any parasitic relationship with the host. It will be seen from the microphotograph Figure 4 that the cuticle, the epidermal cells and the underlying tissues are in no way affected by the alga on the leaf surface. This condition is therefore **not pathogenic.** The only possibility of this alga being disadvantageous to the host is that it may cut down on the amount of sunlight available to the leaf for photosynthesis. This possibility does not appear to be of any significance due to the fact that a test for starch gave no appreciable difference between leaves with and without algae.

Cephaleuros mycoidea is a parasitic alga, the vegetative parts of which establish a parasitic relationship with the host tissues. It will be seen from Figure 5 that the cuticle of the leaf has been displaced by the parasite lying between the cuticle and the epidermis. Eventually the parasite ruptures the cuticle and sends forth its reproductive thalli. These appear on the surface as minute tufts of threads bearing the sporangia which are dispersed by the wind. A distinct host reaction in the form of discoloured cells, probably a barrier layer, is visible in the older spots. The algal spots formed by *Cephaleuros mycoidea* are very few and forms the lesser component of the discolouration.

The spots caused by *Cephaleuros mycoidea* had been observed by the Director in Malaya and is described and illustrated in "Maladies of Hevea in Malaya".

Species of *Cephaleuros* in tropical and sub-tropical regions are parasites growing on many plants including Orange, Lemon, Grapefruit, Magnolia, Avocado, Tea and Pepper. None of these is parasitic to any appreciable degree.

Control measures:

In Malaya where algal spot caused by *Cephaleuros mycoidea* has been recorded, no control measures are recommended since the condition is unimportant and, therefore, need not be treated.

In Ceylon, too, no control measures are required.

References:

Fritsch, F. E. (1935). The Structure and Reproduction of the Algae, Vol. 1.

Gadd, C. H. (1949). Monographs on Tea Production in Ceylon, No. 2.

Hilton, R. N. (1959). Maladies of Hevea in Malaya.

Smith, G. M. and Others (1951). Manual of Phycology.

PLANTING TOPICS

Phytophthora Control in South India

The writer had the opportunity to observe in early May 1961 the large-scale aerial spraying experiments carried out by a group of commercial firms in the rubber growing districts of Kerala State in South-India.

The *Phytophthora* leaf disease constitutes a very serious problem for the rubber planting industry of South-India. The incidence of the disease as experienced in South-India is far more severe than that experienced in any part of the rubber growing districts of Ceylon. Complete defoliation of large areas by *Phytophthora* is frequent in South-India.

Within Kerala State, the incidence of *Phytophthora* varies with the rainfall and the severity of the S.W. monsoon. Thus the southern part, which receives an annual rainfall of only 80 inches, is free of the disease; towards the north, and with increasing annual rainfall up to 200 inches and over, the incidence increases progressively.

A comparison of the rainfall figures for 1958, 1959 and 1960 for Dartonfield Group and for two estates in South-India near Mundakayam is shown below:

Station	Rainfall in inches								
	June			July			August		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
Kuppakayam Estate near Mundakayam...	34.93	39.48	20.74	22.76	44.16	38.59	43.63	24.16	29.30
Manikal Estate near Mundakayam ...	35.04	37.08	19.67	20.14	41.06	36.09	39.61	22.58	24.79
Dartonfield ...	18.33	28.30	7.26	4.96	12.79	20.55	8.43	14.59	2.75
Hedigalla ...	25.51	32.40	7.76	7.04	14.96	12.97	13.44	16.75	1.63
Nivitigalakele ...	19.50	32.71	7.56	6.25	15.52	21.75	8.35	16.93	5.68

Spraying with Bordeaux mixture has been for many years the most effective control method of the *Phytophthora* leaf disease in South-India. As Bordeaux mixture has excellent sticking properties, one spraying round in advance of the monsoon rains provides adequate coverage to protect the leaves of the rubber trees throughout the S.W. monsoon season.

Bordeaux mixture spraying is, however, a rather slow and expensive process and, as 20 labourers are able to spray only 1 acre in 1 day, this method is clearly uneconomic and thus other methods of control have been sought.

Work carried out by the India Rubber Board and commercial firms indicated that copper-based fungicides applied as oil spray formulations would give the best control, far better than dusts or water spray preparations. Difficulties with regard to the performance of the

ground spraying equipment and in obtaining such equipment in India prompted different commercial firms to band together to undertake a large-scale programme of aerial spraying.

The participating firms decided to spray 10,000 acres from the air, either by helicopter or by fixed wing aircraft, with copper-based oil spray formulations.

So far the experiments have shown that it would technically and practically be possible to spray the rubber areas from the air at costs comparable with those of the older methods, the cost being approximately Rs. 50/- per acre per round. It is expected that one aerial application of the copper-based oil spray formulation would provide adequate leaf coverage.

Helicopters appear to be better suited for the purpose than fixed-wing aircraft as they do not require elaborate landing sites and can more easily follow the terrain. A helicopter equipped with a 40 gallon tank is able to spray 10 acres of rubber at the rate of 4 gal. per acre in 3 to 4 minutes. Provided the landing site is close to the area to be sprayed and the weather conditions are favourable, a helicopter can spray about 100 acres in 1 hour, or about 250 to 300 acres in one morning.

The spray deposit obtained by aerial spraying seems good, but an assessment of the aerial method must await the end of the *Phytophthora* season.

A. R.

QUESTION CORNER

Question:

I intend constructing a smokehouse for an estate with an estimated output of over 1,000 lb. rubber per day. I should be obliged for your advice on the most suitable design to adopt.

Answer:

There are four types of smokehouses available for a daily output of 1,000 lb. or over. These are:

1. RRS-type smokehouses (with smoke chamber)
2. Modified RRS-type smokehouses (with outside furnace)
3. R.R.I. of Malaya Tunnel-type smokehouses
4. "Subur"-type smokehouses.

Plans of the RRS-type smokehouses of 5,000 lb. and 10,000 lb. capacity are available on request. These smokehouses can cope with 1,000 lb. and 2,000 lb. rubber, respectively, per day.

The fire trolley furnace system of the RRS-type smokehouse has recently been replaced with an outer brick furnace and underground flues, and the bulking room has been converted into an additional smoking space giving a 50% increase in capacity. Plans of the modified RRS-type smokehouses of 7,500 lb. and of 15,000 lb. capacity are available on request and these smokehouses can cope with 1,500 lb. rubber and with 3,000 lb. rubber, respectively, per day.

Plans of the R.R.I. of Malaya tunnel-type smokehouses designed to handle 1,000 lb. or 2,000 lb. or 4,000 lb. rubber per day are given in the R.R.I. of Malaya Planting Manual No. 9, copies of which are available at this Institute.

The R.R.I. of Malaya tunnel-type smokehouses have the following advantages over the RRS-type smokehouses:—

(*a*) They need less labour for operation.

(*b*) They have a shorter drying cycle and are nearly continuous in operation. RRS-type smokehouses have to be operated at a lower temperature and heating operation has to be stopped each day to change the sheets.

(*c*) Their temperatures are more easily controlled. Hence tunnel-type smokehouses should be an economic proposition for an estate turning out over 1,000 lb. of smoked sheet per day.

It must be pointed out that the modified RRS-type smokehouse and the R.R.I. of Malaya tunnel-type smokehouses are quite unsuitable for an area with a high water table since their furnaces and flues are below ground level. A damp site requires a RRS-type smokehouse or a modified "Subur"-type smokehouse with furnaces and flues above ground level. Reprints of the paper on "Subur" type of

smokehouses' by A Moore & J. H. Piddlesden from the Journal of the Rubber Research Institute of Malaya, Volume 7, page 147, are available on request from this Institute.

In the "Subur" type smokehouses distinct chambers separate the daily crops. In each chamber the temperature and amount of air are carefully controlled according to the state of dryness of the sheets.

All things considered, the choice of the most suitable smokehouse to be constructed would depend on factors such as availability of space, of building materials, cost, etc., and these vary with local conditions.

K. F. H.

Question:

Could you please let me have the necessary information on a practical method of selectively thinning out a high initial stand of clonal seedlings.

Answer:

At the present time we recommend an initial stand of 220 clonal seedlings per acre. A preliminary thinning out could be carried out during the first two years of growth when the runty backward plants are easily spotted. Competition in high stands of clonal seedlings begins in the 4th year of growth and it would be correct to complete the thinning out on growth characters about the end of the 3rd year of age; such a reduction in the stand per acre will reduce the cost of manuring on a per tree basis.

At this stage we take up the systematic thinning out of trees from about 200 to 160 trees by taking out the poorest grown trees as given below:—

From a stand of 20 trees selectively thin out 4 trees
or, „ „ „ „ 10 „ „ „ „ 2 „
or, „ „ „ „ 5 „ „ „ „ 1 tree

The three groups of 20, 10 and 5 will be useful as a workable basis on which the reduction can be made as evenly and systematically as possible. If the poorest grown tree in a group or row of 5 trees is not so obvious, we try the reduction in a group of 10 trees by taking out the 2 poorest grown trees. It may be necessary to eliminate 4 trees in a group of 20 trees in a more evenly growing stand of trees, especially on hill tops, where the growth is uniformly below expected standards of growth. We then have 160 of the best grown trees, which can be tapped on a reduced intensity of 67% on the S/2, d/3 tapping system, when about seventy per cent of the trees have reached a girth of 20″ at a height of 3 feet from ground level.

The poorest yielding trees are eliminated about the end of the third year of tapping after the wind damage, Brown Bast, and other bark disease cases have been fully assessed for preliminary removal. The final reduction is then made by taking out the poorest yielding trees to bring the number of trees down to about 130 trees per acre as a more permanent stand.

It should be remembered that in this country the chances of further casualties due to panel diseases caused by *Phytophthora palmivora* are considerably greater than in rubber planting countries further East.

Some practical planting knowledge is necessary for obtaining a reduced stand of clonal seedling rubber that will give high economic yields per acre.

C. A. DE S.

Question:

When did *Oidium* leaf disease first appear in Ceylon and when was sulphur dusting first used to control it on estates and on smallholdings?

Answer:

The *Oidium* leaf disease was first recorded on *Hevea* in Ceylon in February 1925, simultaneously in low-country and mid-country rubber growing districts.

The causal fungus was identified by T. Petch, Botanist and Mycologist of the Department of Agriculture, and the first account of this sudden outbreak of the disease was by R. H. Stoughton-Harris, Mycologist of the Rubber Research Scheme, in the First Quarterly Circular of the R.R.S. for 1925 under the title "Oidium Leaf Fall of Rubber".

The disease had been known in Java since 1918 and successful control had been obtained there by dusting the young foliage with finely powdered sulphur by means of a motor duster.

Sulphur dusting experiments for the control of *Oidium* were first carried out in Ceylon during the refoliation period of 1930 by R. K. S. Murray, Mycologist of the Rubber Research Scheme, on Kandanuwara and Bandarapola estates in the Matale district, at elevations of about 2,000 feet where the incidence of the disease was the most severe, using a motor duster of Dutch manufacture and sulphur dust imported from Java. Murray's first account of these experiments was published in R.R.S. Second Quarterly Circular for 1930.

Because of the increased severity of the disease in 1934 the Rubber Research Scheme arranged for demonstrations of sulphur dusting to be given in the Central Province for the benefit of smallholders. These demonstrations were organized and supervised by our first Smallholdings Officer, W. I. Pieris, on selected holdings at Gampola, Katugastota, Galagadera, Rattota and Matale North and were highly successful. A full account is given in Pieris' report "Demonstration of the Control of Oidium on Smallholdings in 1935" published in the R.R.S. Combined First and Second Quarterly Circulars 1935.

A State-aided Sulphur Dusting Scheme for smallholders came into operation in the Kegalle District during the 1955 refoliation season when 178 acres of smallholdings were dusted, the first trial dusting being carried out on 18th January at Niyandurupola in the presence of the Chairman of the Rubber Research Board, Mr. W. P. H. Dias, J.P., and of the Smallholdings Propaganda Officer, W. I. Pieris, who organized the Scheme and later published a comprehensive account in the R.R.I.C. Combined Third and Fourth Quarterly Circulars for 1955.

The acreage of smallholdings dusted under the Scheme has steadily increased each year since 1955 and in 1961 comprised 8,835 acres on 2,592 holdings.

E. D. C. B.

RUBBER RESEARCH BOARD

171st Meeting

Minutes of the 171st meeting of the Rubber Research Board held at the Head Quarters of the Planters' Association of Ceylon, 73/1, Kollupitiya Road, Colombo, at 10 a.m. on Tuesday, 24th January, 1961.

Present:—Mr. C. A. de Silva, Acting Director (in the Chair), Mr. N. Abeygoonewardene, Mr. W. P. H. Dias J.P., Senator L. Jayasundera, Mr. B. Mahadeva. (Rubber Controller), Mr. H. E. Peries (Deputy Secretary to the Treasury), Mr. A. V. Richards (Director of Agriculture), Mr. T. C. A. de Soysa, Mr. C. R. Warren Mr. D. P. R. Weerasekera M.P., and Mr. C. D. de Fonseka (Chief Administrative Officer).

An apology for absence was received from Mr. H. Creighton.

1. Board:

(*a*) *Changes in membership.*—The Chairman welcomed Mr. T. C. A. de Soysa and Mr. Nelson Abeygoonewardene who had been nominated to represent the Low Country Products Association with effect from 21st January, 1961, in place of Messrs. S. Pathmanathan and L. C. de Mel.

He also reported that Mr. W. P. H. Dias had been renominated by the Hon'ble Minister of Agriculture, Land, Irrigation & Power to represent the smallholders for a further period of three years with effect from 1st February, 1961.

(*b*) *Election of a Chairman.*—Mr. T. C. A. de Soysa was unanimously elected Chairman.

(*c*) *Nominations to Committees.*—The following nominations were made:—

Administrative Committee:
Mr. T. C. A. de Soysa (in the place of Mr. S. Pathmanathan)
Mr. W. P. H. Dias (additional member)
Mr. Peries' successor on the Board when he retires.

Estate & Experimental Committee:
Mr. T. C. A. de Soysa (in the place of Mr. S. Pathmanathan)
Mr. C. R. Warren (in the place of Mr. L. C. de Mel)

Smallholdings Committee:
Mr. T. C. A. de Soysa (in the place of Mr. S. Pathmanathan)
Mr. D. P. R. Weerasekera (new member).

2. Minutes:

(*a*) *Confirmation.*—Draft minutes of the meeting held on 5th December 1960, which had been circulated to members, were signed by the Chairman.

(*b*) *Matters arising from the minutes:*

(*i*) *Capital Votes.*—A statement showing the position of the 1959 building votes, which had been circulated to members, was considered and it was noted that almost all the items had been completed.

3. **Administrative Committee.**—The recommendations made at the meeting held on 16th January 1961, were considered; the Board's decisions included the following:—

(*a*) *R.R.I.C. Kuruwita Sub-station.*

(i) *Acting Superintendent.*—Agreed that Mr. R. K. Hermon should act as Visiting Superintendent of the Sub-station during the absence on furlough of Mr. B. Cocking with effect from 1st February 1961.

(ii) *Labour accommodation.*—Authority was given for the construction of 12 single cottages at the Sub-station on the basis of the plan and specification approved by the P.A. Estates' Health Scheme.

(*b*) *Audit Query.*—The recommendation made in an audit query that the following tender deposits be recovered in the case of future building contracts was approved:—

Tender deposit—Rs. 100/- (refundable).
Security deposit—5% of the contracted amount.

(*c*) *Requests from Technical Assistants.*—Two requests made by the Technical Assistants were considered and the following decisions were arrived at:—

(i) In regard to the request regarding training abroad, it was agreed that, in the case of academic training of Institute's officers the policy at present adopted by the Department of Agriculture be adopted, *i.e.* to send abroad for training only those officers who have to be sent in accordance with their letters of appointment. In the case of training in laboratory technique, officers who in the opinion of the Director require special training which is not available at the Institute may be considered for training abroad.

(ii) Agreed that the request for improvement of salary scales and facilities for promotion be considered after the Government salaries report is published and a Committee consisting of the Chairman, the Director and Mr. D. P. R. Weerasekera with an officer from the Treasury was appointed for this purpose.

(*d*) *Acting Arrangements, Works Section.*—It was noted that the duties of the Works Inspector had been shared by the Senior Artisan, the Electrician and the Office Assistant of the Estate Dept. since the resignation of Mr. Abeywickrema and the payment of an acting allowance to these officers was authorised.

4. **Smallholdings Selection Committee.**—It was reported that, in accordance with the recommendations of the Selection Committee, Mr. R. A. Somadasa had been appointed Office Assistant, Smallholdings Dept., with effect from 1st January 1961.

5. **Staff:**

Changes.—Changes in staff since the last meeting were reported and approved.

6. International Rubber Research and Development Board.—Minutes of a meeting of the International Rubber Research and Development Board held on 4th October 1960 were tabled.

7. Publications.—The following publications were tabled:—

3rd & 4th Quarterly Journals September/December, 1960.
Advisory Circular No. 69—Defects in Smoked Sheet.

8. Next Meeting.—It was decided that the next meeting of the Board be held at 10.30 a.m. on 27th February 1961 at the Planters' Association Meeting hall, Colombo.

9. Any other business:

(*a*) *Planning Committee.*—The Acting Director reported that he had attended the first meeting of the Ministry of Agriculture Planning Committee recently.

The meeting then terminated.

RUBBER RESEARCH BOARD

172nd Meeting

Minutes of the 172nd meeting of the Rubber Research Board held at the Head Quarters of the Planters' Association of Ceylon, 73/1, Kollupitiya Road, Colombo, at 10.30 a.m. on Monday 27th February 1961.

Present:—Mr. T. C. A. de Soysa (in the Chair), Mr. N. Abeygoonewardene, Mr. W. P. H. Dias J.P., Senator L. Jayasundera, Mr. B. Mahadeva (Rubber Controller), Mr. C. R. Warren, Mr. C. A. de Silva (Acting Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

1. Board:—The Chairman reported that Mr. W. B. Jonklaas had been nominated to represent the Planters' Association of Ceylon in place of Mr. H. Creighton who was leaving the Island. Mr. Creighton was thanked for his services during his period of membership.

2. Minutes:

(A) *Confirmation.*—Draft minutes of the meeting held on 24th January 1961, which had been circulated to members, were signed by the Chairman subject to a minor amendment.

(B) *Matters arising from minutes:*

(i) KURUWITA SUB-STATION.—The decision made at the last meeting to build 12 single labourers' cottages at the Sub-station was re-considered and it was decided to build 6 double cottages instead of 12 single cottages. A vote for this purpose was passed. It was also decided that the Chairman, the Acting Director, Mr. Warren and Mr. Dias should visit the Sub-station.

(ii) CABINET CONCLUSIONS.—It was agreed that the Government language policy be followed as far as possible in the conduct of the Institute's work. In order to implement this decision it was agreed that a Sinhala Translator be appointed and that arrangements be made to provide instruction in Sinhala to Institute's Officers.

(iii) REQUESTS FROM R.R.I.C. EMPLOYEES' UNION.—The following decisions were arrived at in regard to the requests made by the R.R.I.C. Employees' Union:—

(*a*) *Salary Conversion.*—Left for consideration by the Special Committee appointed to revise the salary terms and conditions of the staff.

(*b*) *Arrears of Overtime.*—Arrears should be paid in accordance with Treasury Circular No. 509/12/2(ET/F) 584 of 21st December 1944, with effect from 1st January 1957.

(*c*) *Housing Loans.*—The Provident Fund Rules should be amended to provide for the grant of housing loans.

(*d*) *Distress Loans.*—Distress loans may be granted for the purpose of providing relief in case of a death occuring in an officer's family, subject to the terms of Treasury Circular No. 413 of 22nd November 1957.

(*e*) *Medical Fund.*—Further relief should be provided in cases of severe illness; the rules should be amended for this purpose.

(*f*) *Grading of Field Assistants.*—Senior Field Assistants should be placed in Assistant Staff Grade I and Field Assistants in Assistant Staff Grade II.

3. Estate & Experimental Committee.—The recommendations made at the meeting held on 15th February 1961 were considered; the Board's decision included the following:—

(*a*) *Estate Superintendent's Reports on Dartonfield Group—August to December* 1960—were approved.

(*b*) *Dartonfield Group Accounts—August to October* 1960—were approved.

(*c*) *Kuruwita Sub-station Accounts—September to November* 1960—were approved.

(*d*) *Visiting Agent's Report on Dartonfield Group*—was approved and it was agreed that the recommendations made in the report be implemented immediately after the Estate & Experimental Committee considers the report.

(*e*) *Visiting Agent.*—Agreed that Mr. Douglas Nicol be appointed Visiting Agent on the retirement of Mr. H. Creighton.

4. Staff:

(*a*) *Senior Assistant Advisory Officer.*—Mr. H. H. Peiris, Senior Assistant Advisory Officer, was re-engaged for a further period of 4 years and 3 months.

(*b*) *Changes.*—Changes in staff since the last meeting were reported and approved.

5. Next meeting.—Agreed that the next meeting of the Board be held at 2.30 p.m. on Monday 27th March 1961.

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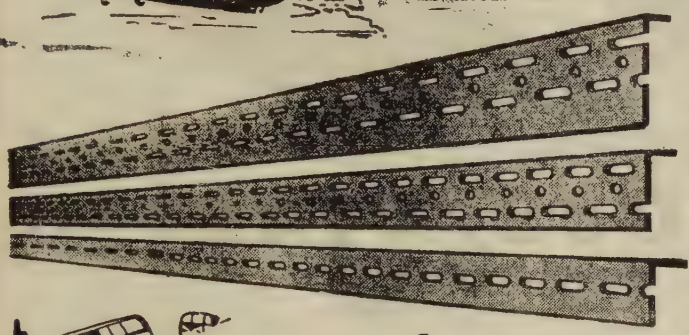

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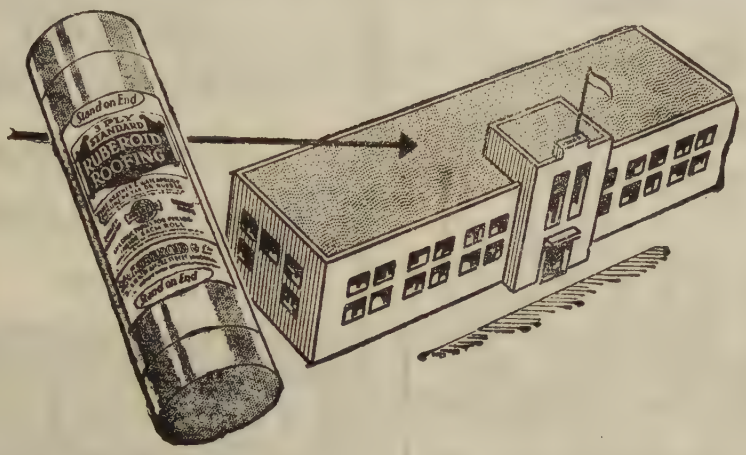

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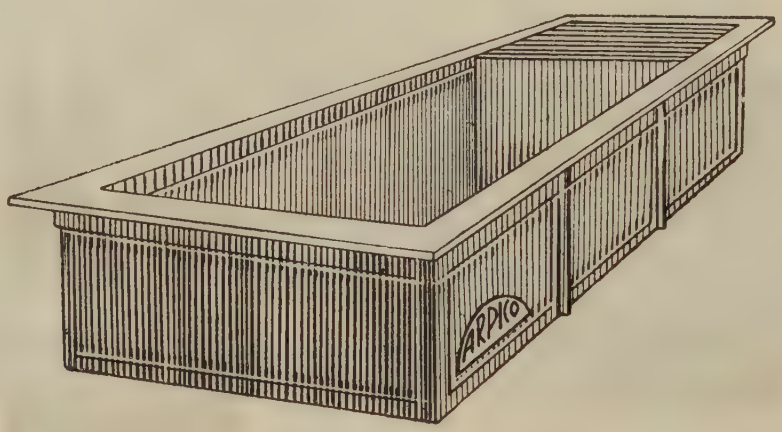

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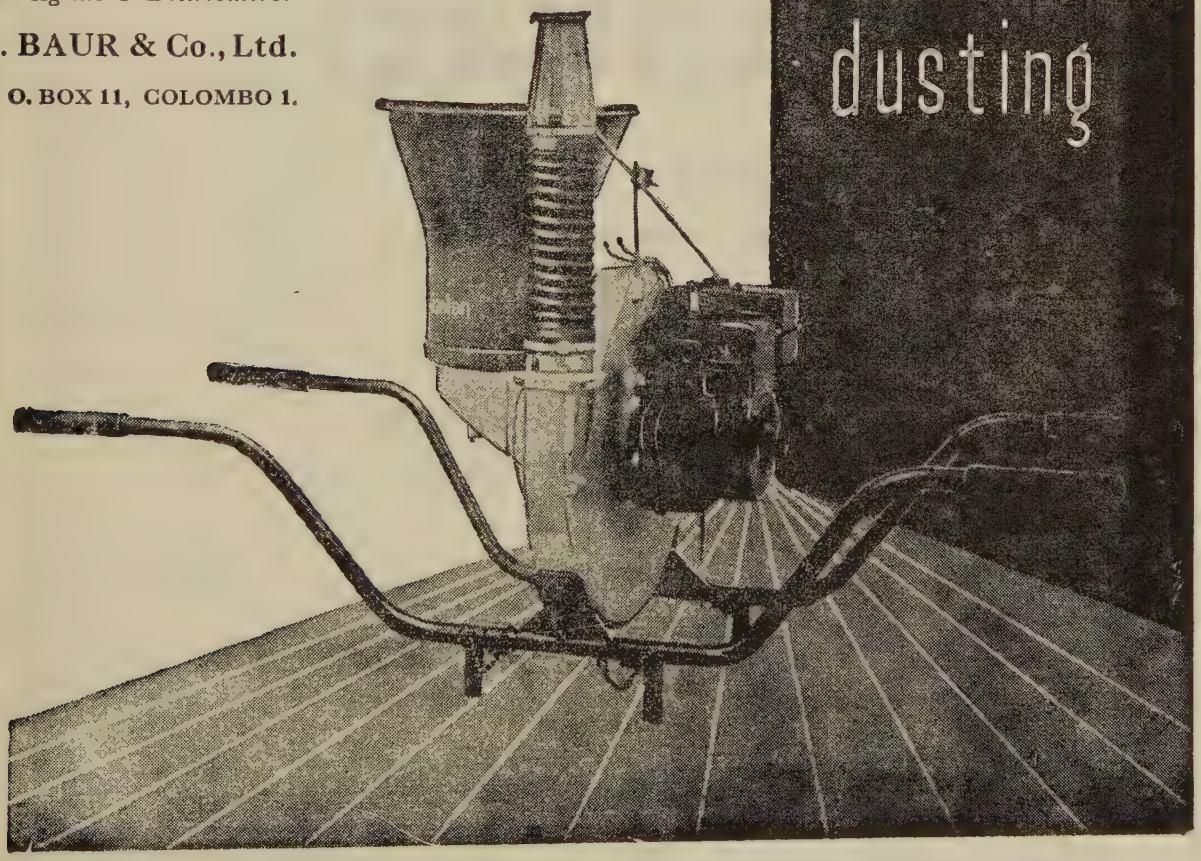

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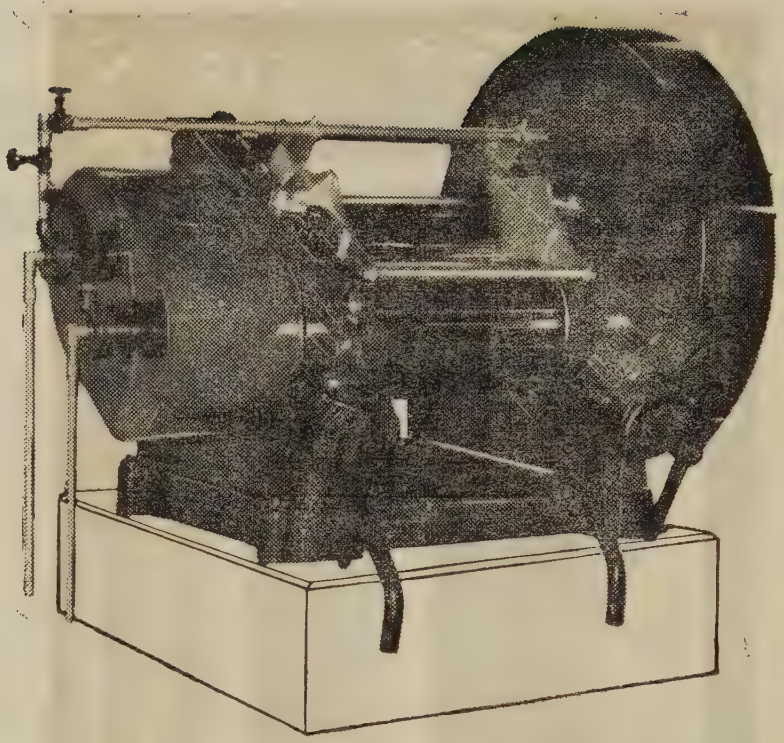

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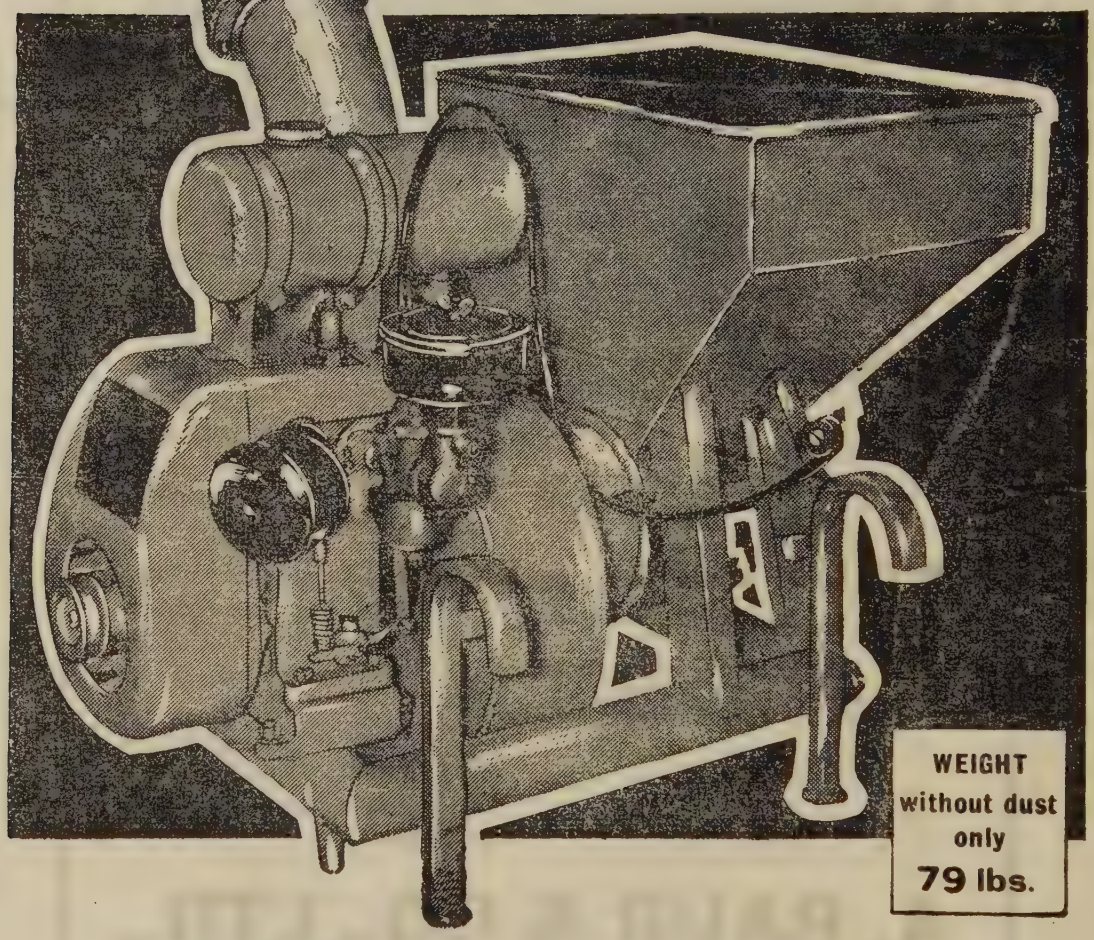

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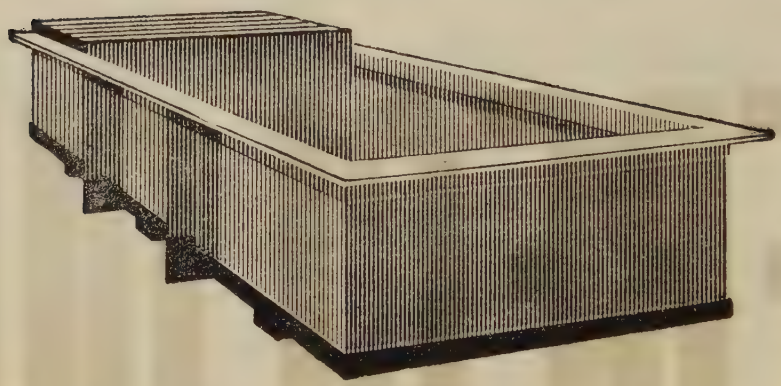

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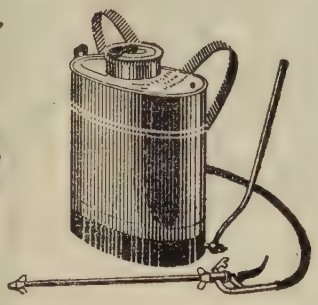

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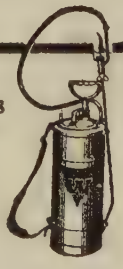

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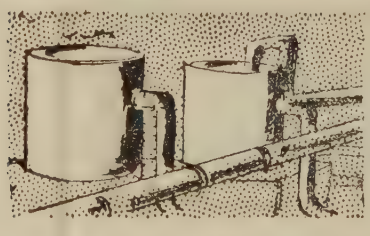

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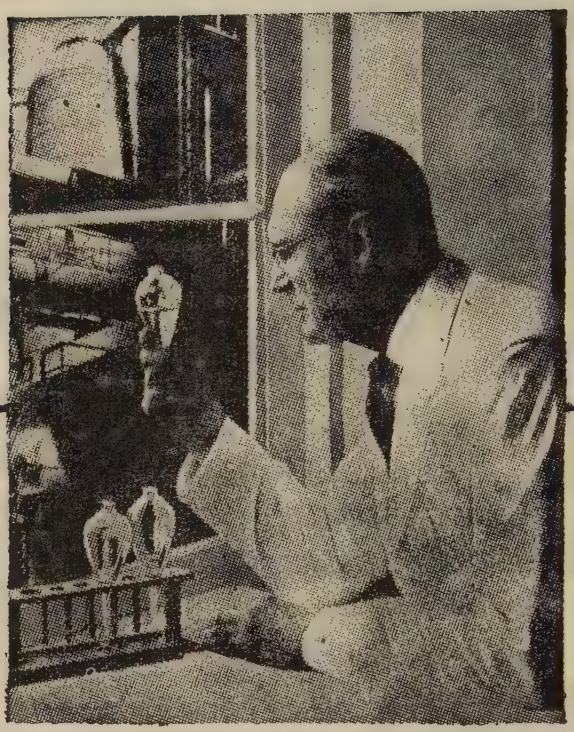

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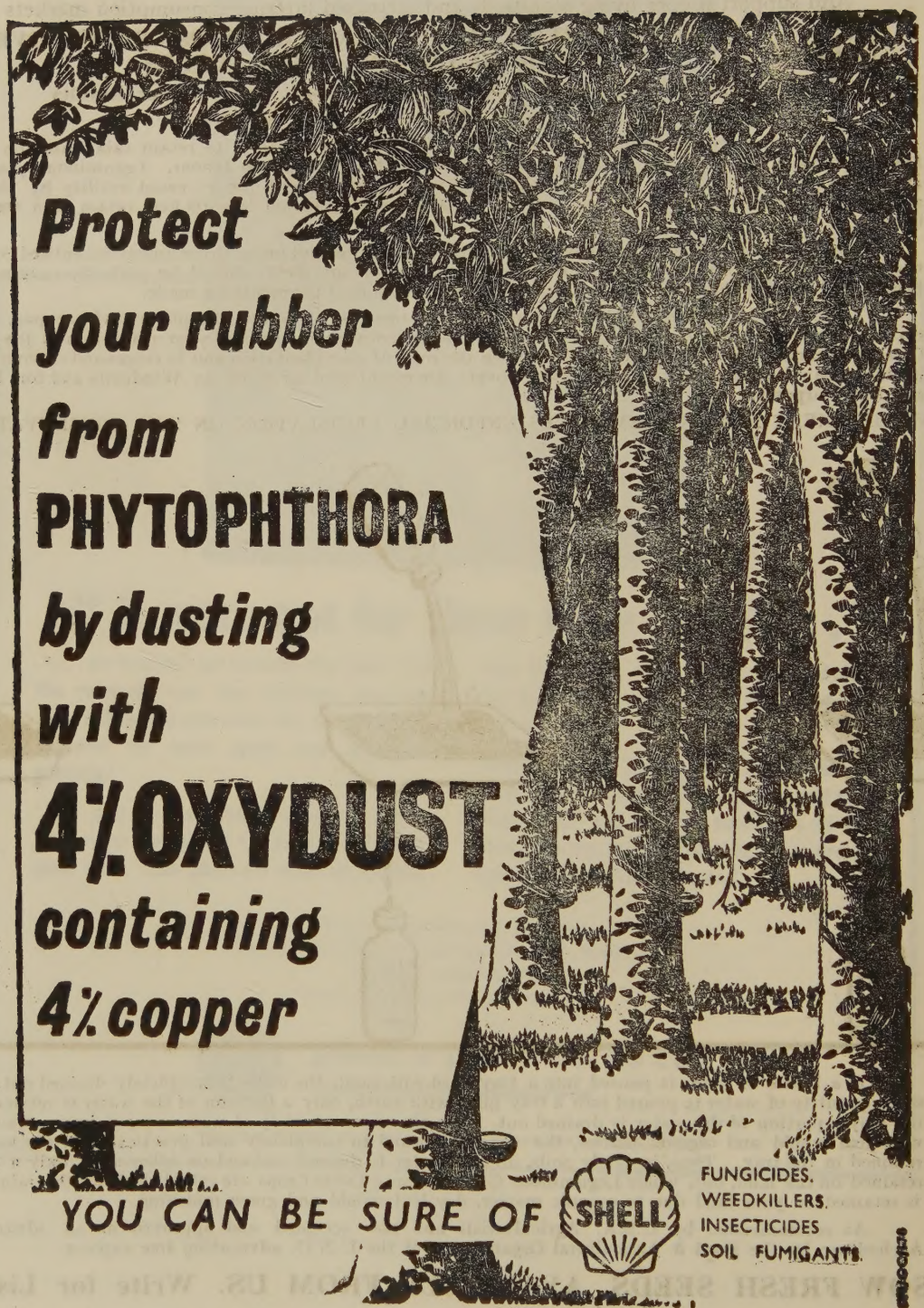
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